

MULTIMEDIA



UNIVERSITY

STUDENT ID NO

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MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2017/2018

TSN2101 – OPERATING SYSTEMS

(All sections / Groups)

4 JUNE 2018

9.00 a.m - 11.00 a.m

(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 7 pages with 6 Questions only.
2. Attempt **FOUR** out of **SIX** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please print all your answers in the Answer Booklet provided.

QUESTION 1

a) State three general methods for passing parameters to the operating system.

[3 marks]

b)

- i) What is the relationship between a guest operating system and a host operating system in a hypervisor like VMware?
- ii) What are the key factors that have to be considered in choosing the host operating system?

[1.5 + 1.5 = 3 marks]

c)

- i) List and briefly describe the FIVE states that a process may be in, when it is being executed.
- ii) Draw the process state diagram depicting the five states

[5 + 2 = 7 marks]

d) When CPU switches from one process to another process, the system must save the state of the old process and load the saved state for the new process via a context switch. Briefly explain why context switch time is considered to be an overhead.

[2 marks]

Continued ...

QUESTION 2

- a) Explain why is it important for the scheduler to distinguish I/O-bound programs from CPU-bound programs?

[4 marks]

- b) Consider the following set of processes:

Process	Arrival time	Burst-time
P1	0	7
P2	1	1
P3	2	2
P4	7	3
P5	4	4

- i) Draw the Gantt charts illustrating the execution of these processes using **Preemptive Shortest Job First**, **Non-Preemptive Shortest Job First** and **Round Robin (quantum = 2)** scheduling.

[2 + 2 + 2 = 6 marks]

- ii) What are average turnaround times for **Preemptive Shortest Job First** and **Non-Preemptive Shortest Job First** algorithms?

[2.5 + 2.5 = 5 marks]

Continued ...

QUESTION 3

- a) Describe a scenario when using a reader-writer lock is more appropriate than another synchronization tool such as a mutex with a semaphore.

[5 marks]

- b) Consider the following system with **FIVE** processes and **THREE** resource types:

- A has 12 instances
- B has 12 instances
- C has 11 instances

The snapshot of the system is given as:

Process	Allocation	Max
	A B C	A B C
P0	0 2 1	1 2 2
P1	3 2 1	9 8 6
P2	1 2 3	3 7 3
P3	2 3 2	4 3 5
P4	4 1 2	6 8 8

Available
A B C
2 2 2

Answer the following questions using the banker's algorithm:

- i) What is the content of the matrix *Need*?

[2.5 marks]

- ii) Find a sequence of processes that will get the system into a safe state, if there is any. Show all required steps.

[5 marks]

- iii) P0 makes a request for 2 instances of A, 3 instances of B 3 and 5 instances of C. Check whether the request can be granted. Briefly explain your answer.

[2.5 marks]

Continued ...

QUESTION 4

- a) In paging, pages in memory are tracked through the use of page tables. Describe the elements of a hashed page table.

[4 marks]

- b) Assume that a system has a TLB hit ratio of 75%. It requires 25 nanoseconds to access the TLB, and 100 nanoseconds to access main memory. What is the effective memory access time in nanoseconds for this system?

[2 marks]

- c) Identify the page numbers and offsets for the following address references (given as decimal numbers). Assume the page size is 4 KB (1 KB = 1024 B).

- 20455
- 40055
- 555
- 6255

[0.5 + 0.5 + 0.5 + 0.5 = 2 marks]

- d) Consider a system that uses a three-level page table with page size of 1 KB and 64-bit logical addresses. The first 16 bits of the address serve as the index into the first-level page table, and the last 16 bits serve as the index into the third-level page table.

- i) How many bits are needed to specify the second-level index?
- ii) How many entries are in a level-one page table?
- iii) How many entries are in a level-two page table?
- iv) How many pages are in the virtual address space?

[0.5 + 0.5 + 0.5 + 0.5 = 2 marks]

Continued ...

- e) Consider the following page table in memory.

Frame	Valid/Invalid Bit
4	i
2	v
6	v
24	i
16	i
10	i
8	v
12	i

Assume that the page size is 1 KB (1024 B), check whether the virtual addresses below generate page faults. If the address does not generate a page fault, identify its physical address.

- i) 654
- ii) 1444
- iii) 2574
- iv) 3604

[2 marks]

- f) Explain the distinction between a demand-paging system and a paging system with swapping.

[3 marks]

Continued ...

QUESTION 5

- a) Consider the following page reference string:

5 2 3 4 2 5 4 2 3 4

Assume the availability of **THREE** frames and all the frames are initially empty. Consider the **First In First Out (FIFO)**, **Least Recently Used (LRU)** and **Optimal (OPT)** page replacement algorithms for Virtual-memory management.

- Identify the number of page faults that would occur if FIFO is used.
- Identify the number of page faults that would occur if LRU is used.
- Identify the number of page faults that would occur if OPT is used.

Show all steps involved.

[3 + 3 + 3 = 9 marks]

- b) In order to manage files, the OS makes use of in-memory structures. Briefly describe the in-memory structures that may be used to implement a file system.

[4 marks]

- c) A 8 TB hard disk with a 16 KB block size is using bitmap to maintain free space list. How much disk space (in MB) is needed to store the bitmap?

[2 marks]

Continued ...

QUESTION 6

- a) The OS sometimes has to manage multiple disks if they are present. Describe one technique that can enable multiple disks to be used to improve data transfer rate.
[2 marks]

- b) Suppose that a disk drive has 2000 cylinders, numbered from 0 to 1999. The drive is currently serving a request at cylinder 1145, and the previous request was at cylinder 1125. The queue of pending requests, in FIFO order, is

65, 1455, 825, 1765, 935, 1415, 1115, 1815, 125

Starting from the current head position, what is the **schedule** and the **total distance** that the disk arm moves to satisfy all the pending requests, for each of the following disk-scheduling algorithms?

- FCFS
- LOOK
- C-SCAN

[3 + 3 + 3 = 9 marks]

- c) Windows 7 uses a page-based virtual memory management scheme. How can the VM manager improve performance?
[4 marks]

End of Exam

